

HIGH PERFORMANCE CAR AUDIO
ORION

HIGH PERFORMANCE CAR AUDIO
AMPLIFIERS, SIGNAL PROCESSORS
AND LOUDSPEAKERS

DEQ 30 MANUAL



DESIGNED AND ENGINEERED IN THE USA

ORION
HIGH PERFORMANCE CAR AUDIO

NOTES

INTRODUCTION

Thank you for your purchase of the ORION DEQ 30. The latest technological advancement in car audio signal processing, the DEQ 30 is the worlds first stand alone digital 30 band 2 channel equalizer. The DEQ 30 processes all the equalization in the digital domain and comes equipped with both analog to digital and digital to analog converters. The DEQ 30 contains four preset stations called "zones" which allow storage of several equalization curves. This is especially useful in sound-off competition where the DEQ 30 presets can be set for "Sound Quality," "RTA," "SPL" and regular listening. The addition of a DEQ 30 to a system is a must for a competition system and for people who demand the best.

This manual is designed to answer your questions about this product. To accomplish this task, the manual is divided into several different sections according to the type of questions you may have. These sections are Introduction, What's in the Box, Technical Overview, System Planning, Installation, User Interface, Trouble Shooting, Specifications and Warranty. In the event you have questions not covered in this reference, please refer questions to your local Authorized ORION Dealer. Record your serial number and date:

Serial Number: _____

Date of Purchase: _____

WHAT'S IN THE BOX

QTY	Description
1	DEQ 30
1	4 conductor 12 gauge power connector
4	#8 Phillips Pan Head Screws
1	DEQ 30 Reference Manual



NOTES

WARRANTY

LIMITED TWO YEAR CONSUMER WARRANTY:

Directed Electronics, Inc. promises to the original purchaser, to replace this product should it prove to be defective in workmanship or material under normal use, for a period of two years from the date of purchase by the dealer as indicated by the date code marking of the product PROVIDED the product was installed by an authorized Directed dealer. During this two year period, there will be no charge for this replacement PROVIDED the unit is returned to Directed, shipping pre-paid. If the unit is installed by anyone other than an authorized Directed dealer, the warranty period will be 1 year from date of purchase by the dealer as indicated by the date code marking of the product. During this 1 year period, there will be no charge for this replacement PROVIDED the unit is returned to Directed, shipping pre-paid. This warranty is non-transferable and does not apply to any unit that has been modified or used in a manner contrary to its intended purpose, and does not cover damage to the unit caused by installation or removal of the unit. This warranty is void if the product has been damaged by accident or unreasonable use, neglect, improper service or other causes not arising out of defects in materials or construction. ALL WARRANTIES INCLUDING BUT NOT LIMITED TO EXPRESS WARRANTY, IMPLIED WARRANTY, WARRANTY OF MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, AND WARRANTY OF NON-INFRINGEMENT OF INTELLECTUAL PROPERTY ARE EXPRESSLY EXCLUDED TO THE MAXIMUM EXTENT ALLOWED BY LAW, AND DIRECTED NEITHER ASSUMES NOR AUTHORIZES ANY PERSON TO ASSUME FOR IT ANY LIABILITY IN CONNECTION WITH THE SALE OF THE PRODUCT. DIRECTED HAS ABSOLUTELY NO LIABILITY FOR ANY AND ALL ACTS OF THIRD PARTIES INCLUDING ITS AUTHORIZED DEALERS OR INSTALLERS. Unit must be returned to Directed, postage pre-paid, with: consumer's name, telephone number, and address, authorized dealer's name and address, and product description. IN ORDER FOR THIS WARRANTY TO BE VALID, YOUR UNIT MUST BE SHIPPED WITH PROOF OF INSTALLATION BY AN AUTHORIZED DIRECTED DEALER. ALL UNITS RECEIVED BY DIRECTED FOR WARRANTY REPAIR WITHOUT PROOF OF DIRECTED DEALER INSTALLATION WILL BE COVERED BY THE LIMITED 1 YEAR PARTS AND LABOR WARRANTY. Note: This warranty does not cover labor costs for the removal and reinstallation of the unit.

BY PURCHASING THIS PRODUCT, THE CONSUMER AGREES AND CONSENTS THAT ALL DISPUTES BETWEEN THE CONSUMER AND DIRECTED SHALL BE RESOLVED IN ACCORDANCE WITH CALIFORNIA LAWS IN SAN DIEGO COUNTY, CALIFORNIA.

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TECHNICAL OVERVIEW

Designed for the person who competes, the DEQ 30 is a must for all high-end systems. Either channel of the DEQ 30 can be adjusted individually or linked together. The DEQ 30 can accept direct digital inputs (TOSLINK or COAX), conventional RCA inputs or Mini-XLR™ balanced inputs. The DEQ 30 processes all equalizer functions in the digital domain.

With four separate universal presets, you can equalize for SPL, sound quality or any other sound you want. After processing, a digital output can be connected to an outboard D/A converter or done internally with an 18 bit, 192 times oversampling converter with our patented C-Lock™ anti-jitter circuit.

Analog outputs are standard RCA or balanced Mini-XLR™ with an incredible 4 volts output. For the future there is a serial data port to use with an additional controller or a computer.



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TECHNICAL OVERVIEW

TRUE DIGITAL EQUALIZATION:

All equalization is performed digitally by proprietary digital algorithms. Digital equalization achieves perfect phase response. The signal-to-noise ratio is unaffected by equalization adjustments. Frequency centers, boost levels and "Q" values are exact. There is no variance like analog circuits. Additionally, digital equalization eliminates oscillations normally associated with analog circuits.

30 BANDS SEPARATE LEFT AND RIGHT ADJUSTMENT:

30 bands of equalization set to the exact frequencies on 1/3 Real Time Analyzers. Left and right channels can be adjusted individually.

4 PRESET WORKING ZONES:

4 working zones create different preset response curves for every listening preference.

ANALOG INPUT SECTION:

THE DEQ 30 uses an 18 bit balanced delta sigma analog-to-digital converter with 128 times oversampling. It accepts both RCA and Balanced (Mini XLR™) inputs. Left and right input sensitivity adjustments are fully variable and independent.

DIGITAL INPUT SECTION:

The digital input section uses a Professional Grade SPDIF receiver. It uses the same receivers used in high-end home audio and professional applications. The DEQ 30 supports 44.1 kHz and 48 kHz sampling frequencies and both TOSLINK and COAX digital inputs.

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SPECIFICATIONS

• ANALOG OUTPUT SECTION

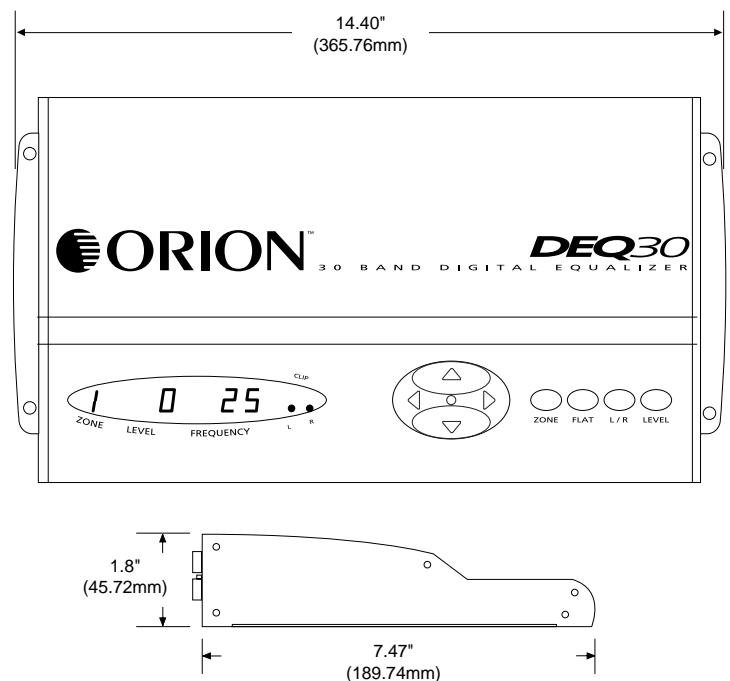
- 1 bit Phillips D/A converter with 18 bit resolution.
- 192 times oversampling
- Low total harmonic distortion
- No crossover distortion
- Digital De-emphases
- RCA and Balanced (Mini XLR™) Outputs
- 4 Volts rms output (per phase)
- Signal-to-noise ratio greater than 100 dB

DIGITAL OUTPUTS

- Professional Grade SPDIF transmitters
- Same transmitters used in high-end home audio and professional applications
- Output frequency 44.1 kHz
- Supports both TOSLINK and COAX digital formats

DIMENSIONS

- (L x W x H) 7.47" x 14.40" x 1.8"
189.74mm x 365.76mm x 45.72mm



SPECIFICATIONS

TRUE DIGITAL EQUALIZATION

- All equalization is performed by proprietary digital algorithms
- Achieves perfect phase response
- Signal-to-noise ratio unaffected by equalization adjustments
- Eliminates oscillations associated with analog circuits
- Frequency centers, boost levels and "Q" values are exact. No variance like analog circuits.

30 BANDS SEPARATE LEFT AND RIGHT ADJUSTMENT

- 30 bands of equalization set to the exact frequencies on 1/3 Real Time Analyzers.
- Left and right channels can be adjusted individually.

4 PRESET WORKING ZONES

- 4 working zones allows for different preset curves for different listening preferences.

COMPUTER INTERFACE

- RS-232 data interface
- IBM computer compatible
- Optional remote interface (Future Release)

ANALOG INPUT SECTION

- 18 bit balanced sigma delta analog-to-digital converter.
- 192 times oversampling
- Accepts both RCA and Balanced (Mini XLR™) inputs
- Separate left and right input level setting

DIGITAL INPUT SECTION

- Professional Grade SPDIF receiver
- Same receiver used in high-end home audio and professional applications
- Supports both 44.1 kHz and 48 kHz sampling frequencies
- Supports both TOSLINK and COAX digital inputs

POWER SUPPLY

- Balanced high-frequency power supply
- Power and Signal grounds floating for complete noise isolation.

C-LOCK™ ANTI-JITTER REDUCTION CIRCUIT

- Eliminates Jitter from any digital source

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ANALOG OUTPUT SECTION:

The analog output section uses dual wide dynamic range 18 bit continuous bitstream auto calibration digital-to-analog converters (made by Phillips) with 192 times oversampling. It has low total harmonic distortion devoid of crossover distortion and incorporates digital de-emphasis. The DEQ 30 has both RCA and Balanced (Mini XLR™) Outputs. The output voltage is 4 Volts rms for the RCA outputs and 8 Volts rms (4 Volts rms output per phase) for a balanced system.

DIGITAL OUTPUTS:

Digital outputs use Professional Grade SPDIF transmitters. These are the same transmitters used in high-end home audio and professional applications. The output frequency is 44.1 kHz. The DEQ 30 supports both TOSLINK and COAX digital formats.

C-LOCK™ ANTI-JITTER REDUCTION CIRCUIT:

C-Lock™ Anti-Jitter clock recovery system virtually eliminates jitter from a digital signal. Jitter in a digital signal creates amplitude errors in rapidly changing signals. The C-Lock™ circuitry strips away the existing clock information and replaces it with a reconstituted correctly timed clock. The result is a perfectly timed digital signal.

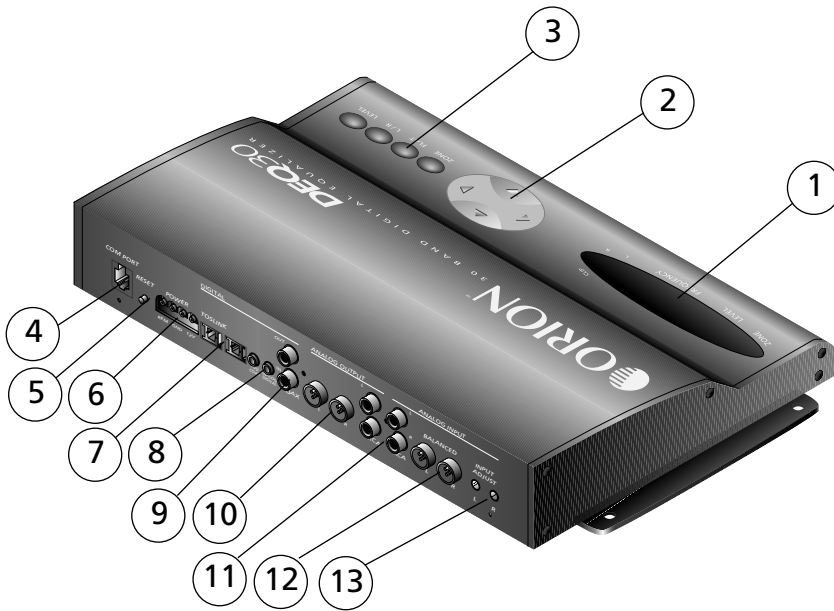
POWER SUPPLY:

The power supply used in the DEQ 30 is a balanced high-frequency power supply. For optimal noise isolation, power and signal grounds are isolated.

COMPUTER INTERFACE:

The DEQ 30 uses a RJ-11 port that supports a IBM computer compatible RS-232 data interface. Additionally, there will be an optional remote interface that will be released in the future.

CALL OUT FEATURES



1. LED Display
2. Parameter Adjustment Key Pad
3. Parameter Selection Buttons
4. RS-232 Data Control Port
5. DSP Reset Button
6. Power connections
7. TOSLINK digital inputs and outputs
8. Digital input selection switches
9. COAX digital inputs and outputs
10. Balanced outputs
11. RCA inputs and outputs
12. Balanced inputs
13. Analog input level adjustment

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Distorted output	Unit's input sensitivity set too high. Exceeding maximum capability of audio outputs.	Reset input gain. Refer to section "Setting Analog Input Levels"(page 12) in this manual for detailed instructions.
	Poor output connections.	Check output connections and fix or replace as needed.
	Signal processors are blown or damaged.	Check system with known working signal processors and fix or replace as needed.
Poor bass response	Amplifiers are blown or damaged.	Check system with known working amplifiers and fix or replace as needed.
	Speakers are blown or damaged.	Check system with known working speakers and fix or replace as needed.
	Speakers wired with wrong polarity causing cancellation at low frequency.	Check speaker polarity and fix as needed.
	Balanced inputs are wired with wrong polarity causing cancellation at low frequency.	Check balanced cable polarity and fix as needed.
Battery fuse blowing	Short in power wire or incorrect power connections.	Check power and ground connection and fix or repair as needed.
	Fuse used is smaller than recommended.	Replace with proper fuse size.
	Too much current being drawn.	Check power and ground connections and fix or repair as needed.
Unit fuse blowing	Too much current being drawn.	Check power and ground connections and fix or repair as needed.
	Fuse used is smaller than recommended.	Replace with proper fuse size.

TROUBLE SHOOTING

Symptom	Probable Cause	Action to take
No output	Low or no remote turn-on input	Check remote turn-on voltage output at amplifier and fix as needed.
	Fuse blown	Check power wire integrity and check for speakers shorts. Fix as needed and replace fuse.
	Power wire not connected	Check power wire and ground connection and fix or replace as needed.
	Audio input not connected	Check input connections and fix or replace as needed.
	Audio output not connected	Check output connections and fix or replace as needed.
	Speakers are blown	Check system with known working speaker and fix or replace speakers as needed.
	Amplifier not working	Test with known working amplifier and repair or replace amplifier as needed.
No output	Analog/Digital input selector improperly configured.	Reconfigure analog/digital input selector to its proper setting.
	TOSLINK/COAX input selector improperly configured.	Reconfigure TOSLINK/COAX input selector to its proper setting.
	Analog input gains set to low	Reset input gains. Refer to the section "Setting Analog Input Levels" (Page 12) in this manual for details
Audio cycles on / off	Thermal protection engage when unit temperature exceeds 90°C	Make sure there is proper ventilation for unit and improve ventilation as needed.
	Loose or poor audio input	Check RCA connections and fix or replace as needed.
	Loose power connections	Check power wire and ground connections and fix or replace as needed.

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INSTALLATION

The installation of all ORION components will determine the overall performance result. Improper installation will not only limit the performance of your ORION system but also potentially compromise the reliability of this digital processor. To ensure proper sonic results and component reliability, please refer to your Authorized ORION dealer for installation assistance and advice. If you decide to perform the installation yourself, read the entire installation section of this manual before beginning the installation.

TOOLS FOR THE TRADE

Listed are tools required to perform the installation. Having the proper tools will make the installation that much easier. Some of these tools are necessities. Some make the job much easier.

- marking pen
- electric drill with assorted drill bits
- utility knife
- Phillips and flat blade screwdrivers
- pliers (standard and needle nose)
- wire brush or sandpaper for chassis grounding
- solder iron and solder
- grommets
- heat shrink tubing
- nylon tie straps
- volt/ohm meter (optional)
- wire cutters
- wire crimpers
- wire strippers
- RTA (real time analyzer)
- Reference CD with 1 kHz Sine Wave at 0dB level (all bits high)



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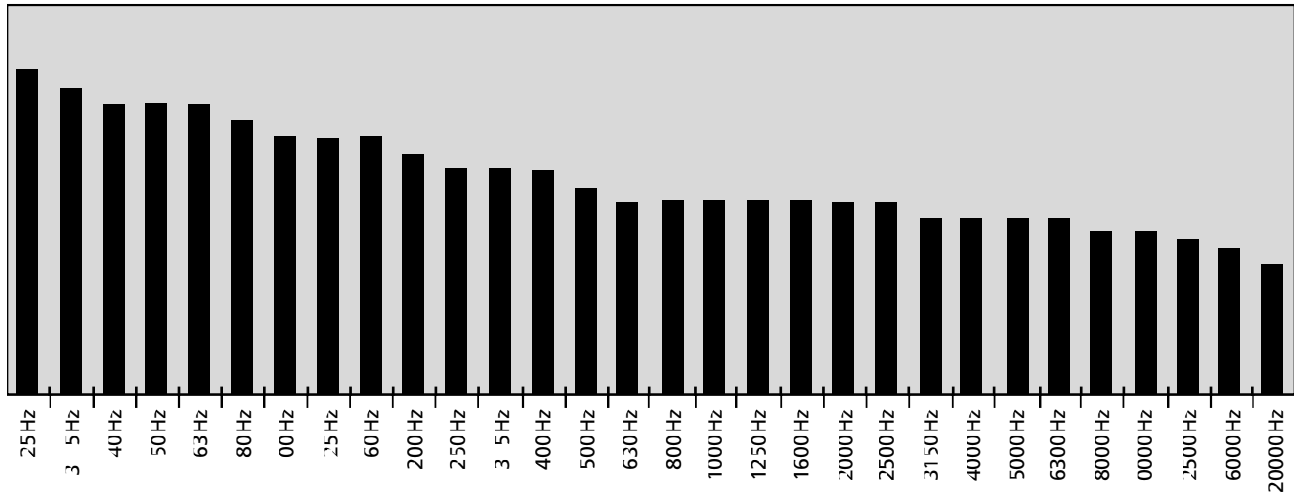
POWER CONNECTIONS



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The above corrected response is not a perfectly flat curve. For good sound quality in a vehicle a flat curve may sound great when the vehicle is stopped and the engine is off. However, most people put systems in cars to listen to great music with the engine running while driving. The above response is not a mandate for good quality sound in a vehicle but one example of a frequency response that has smooth transitions from octave to octave and compensates for the road and vehicle noise. To get the best sound quality in a system, use an RTA to detect and resolve problems but use your hearing to determine if the finished product is acceptable. Because you are the one listening and enjoying the system, not the RTA, Orion brings you one step closer to a perfect system with the DEQ 30. Enjoy!

CORRECTED RESPONSE



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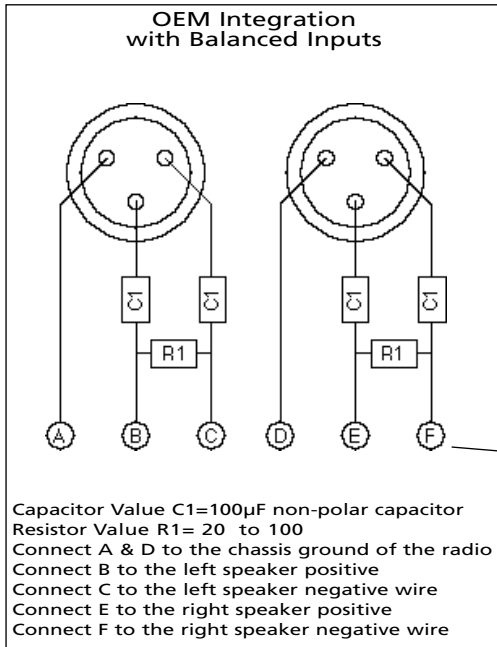
DEQ 30's power supply is an ultra-quiet balanced high-frequency supply. All power and signal grounds are isolated for complete noise rejection.

- Power connections made through large four terminal removable connector.
- Connect 12V+ to the battery through fuseholder. This connection provides +12V main power to the DEQ 30.
- Power wire must be fused less than 18" from battery.
- Ground unit to chassis as close as possible.
- Connect one REM terminal to remote turn-on lead from source unit. This connection provides +12V power to turn-on the DEQ 30.
- Connect one REM terminal to REM terminals on amplifiers and additional trunk mounted signal processors. This connection provides +12V to the remote turn-on leads of the amplifiers to amplifiers on.

NOTE: A power reset button located next to the power connections terminal is useful for resetting the microprocessor in the unlikely event of processor lock up.

SPECIAL NOTE: There is an internal 1.5 AMP AGC fuse located in the DEQ 30. This fuse is designed to blow only in extreme situations like power surges in the vehicles electrical system. In this type of situation, the internal fuse serves to protect the DEQ 30 from potential damage.

ANALOG INPUTS



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Time alignment errors are caused by speakers that are located at different distances relative to the listening position. Time alignment errors are difficult to detect only using an RTA. In some cases, time response errors can be indicated by a shelving effect of a particular driver (in the above situation the tweeters) in such a way that the response is smooth but appears to be disjointed from the adjacent drivers.

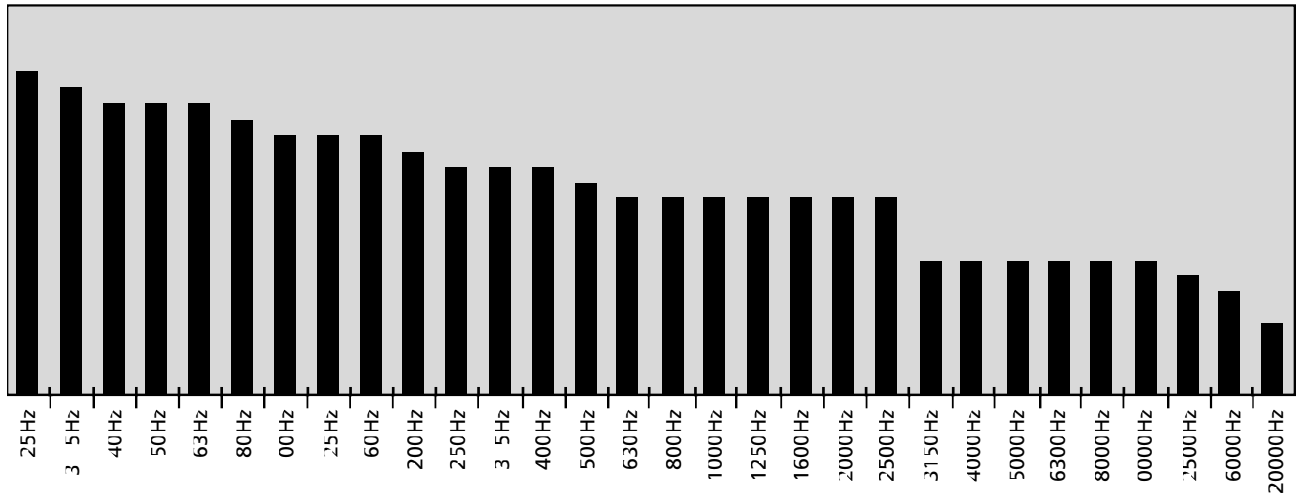
Non-Equalizer Solutions

This problem can be better identified by using a time delay device (usually digital) to delay the apparent louder drivers. In the above situation, this would be the midrange. When using time alignment, first integrate the midrange and tweeters then add the woofers. If you delay a set of drivers and the response does not change, then the problem is not time related and you should employ methods discussed in "Output Level Incompatibility Problems."

Equalizer Solutions

Use the DEQ 30 first as a cut only device to try to smooth out the non-linearity of the system. Cut frequencies gradually starting with the center point of the problem area. Do not cut the centered band to get the frequency response to the flat position for it will dip below when you change adjacent bands. When boosting the DEQ 30 is required, take care not to exceed the maximum undistorted output level of the DEQ 30. For reference, an illuminated "Clip" LED indicates that the maximum output level has been exceeded. Periodically listen to your system during this process to make sure that the changes improve the system.

TIME ALIGNMENT ERROR PROBLEMS



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The DEQ 30 can accept either balanced (Mini-XLR™) inputs or RCA inputs. However, only one input can be chosen per installation. The DEQ 30 was not designed to be a multi-source input selector. The system designer/installer must determine which configurations will work and yield the best sound quality.

The input sensitivity is adjusted with separate left and right input level potentiometer. Input range from 150 mV up to 10 Volts rms (per phase). The balanced inputs are perfect for an OEM interface (see diagram above). The added capacitors eliminate any potentially damaging DC offset from an OEM source unit. The added resistors load the source unit so that a power fader, if applicable, will operate correctly.

The analog-to-digital conversion is handled by an 18 bit balanced delta sigma analog-to-digital converter. It has 192 times oversampling. It is the same converter used in high-end professional recordings. The result is a near invisible conversion from the analog to the digital domain.

Properly setting the level of the DEQ 30 requires a test disc with a tone recorded at all bits high (the highest possible recording level). A clip indicator informs you if the level is too high. If you do not have a test disc you can still adjust the input levels but it is much more difficult to maximize the system.

The beauty of DEQ 30 is that the signal-to-noise ratio does not degrade with boost. As long as the equalizer is not clipped, boosting the DEQ 30 will not add any distortion or noise. Since most musical recordings never reach a high recording level in the upper frequency range, the DEQ 30 will allow you to boost the upper bands without penalty.

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SETTING ANALOG INPUT LEVELS

1. Install DEQ 30 into your system.
2. With your source unit volume control set at a low position, test the function of the system. Once satisfied proceed to the next step.
3. Turn the gain controls of the DEQ 30, your amplifiers and other components in your system to their minimum positions.
4. Cue up the reference CD to the track with the 1 kHz test tone at "all bits high". This is also referred to as "0dB." If you do not have a CD player, see *Non CD Setup*.
5. Set your volume on your source unit to 3/4 volume.
6. Slowly turn up the gain controls on the DEQ 30 until you can hear the pure tone. HINT! The lower the initial volume the better.
7. Turn up your volume of your source unit until the output of the pure tone becomes distorted (sounds like fuzziness in the tone) and then turn back down until you hear a pure tone again. The maximum undistorted output of the source unit is now set.



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Absorption/Reflection Related Non-Linearity Problems are caused by the interaction of speakers with the interior acoustics of the vehicle. Examining the speaker mountings and locations may give clues to potential problems and potential solutions. Be sure the speakers have an un-obstructed path to the listening position. Any object in the speakers path will affect the sound quality of the system.

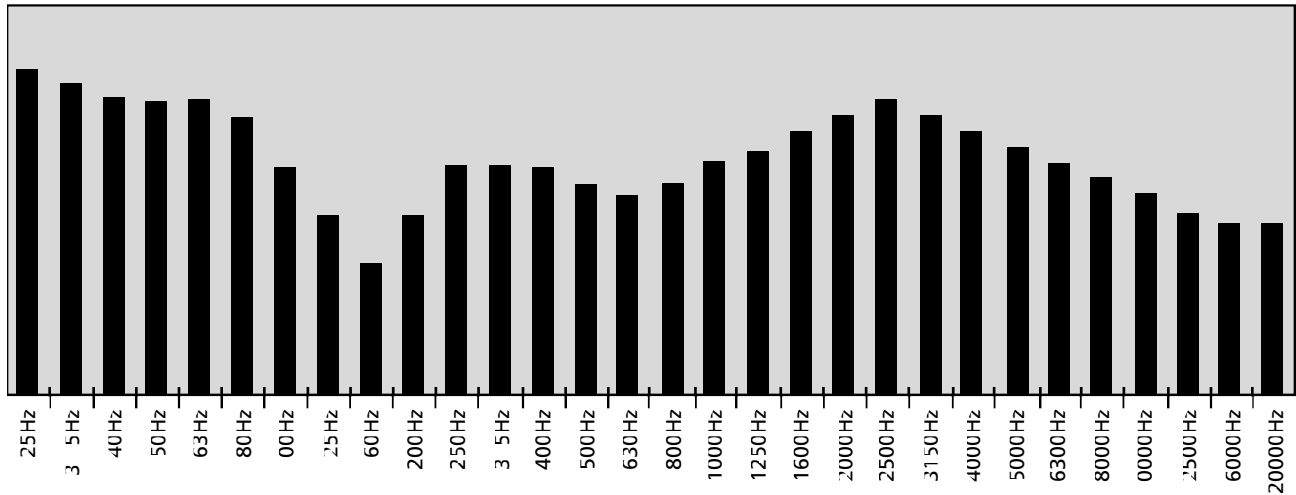
Non-Equalizer Solutions

Examine the surrounding of the speaker. If any object blocks the path of the speakers remove it. If this is not possible, minimize the effect of the obstruction by applying a type of absorption material on the object like felt or high density fiberglass. Install the absorption material in the path between the speaker and the obstruction so as to minimize the effect. If the rear of the speaker (midrange or woofer) is close to a reflective panel, place damping material between the speaker and the reflective baffle. Also if any frequency response errors occur near crossover points, try changing the speaker polarity of the speaker or try using different crossover frequencies.

Equalizer Solutions

Use the DEQ 30 first as a cut only device to try to smooth out the non-linearity of the system. Cut frequencies gradually starting with the center point of the problem area. Do not cut the centered band to get the frequency response to the flat position for it will dip below when you change adjacent bands. When boosting the DEQ 30 is required, take care not to exceed the maximum undistorted output level of the DEQ 30. For reference, an illuminated "Clip" LED indicates that the maximum output level has been exceeded. Periodically listen to your system during this process to make sure that the changes improve the system's advanced equalization.

ABSORPTION/REFLECTION RELATED NON-LINEARITY PROBLEMS



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8. Disconnect the output of the DEQ 30 from the rest of the system.
9. Leaving the source units volume control alone, slowly increase the left gain of the DEQ 30 until the "CLIP" LED indicator becomes illuminated. The output of the DEQ 30 is currently clipped.
10. Turn down the left gain control until the LED goes out. HINT! The closer the gain is set to the point where the LED goes out the better signal-to-noise ratio and channel output balance you will have. The output of the DEQ 30 is now optimally set for the left channel.
11. Repeat steps 9 & 10 for the right channel gain. Your DEQ 30 is now perfectly level matched for your system. Maximum output on your CD player will yield more than 4 volts rms (per phase) output. The DEQ 30 is also optimally configured for digital output.

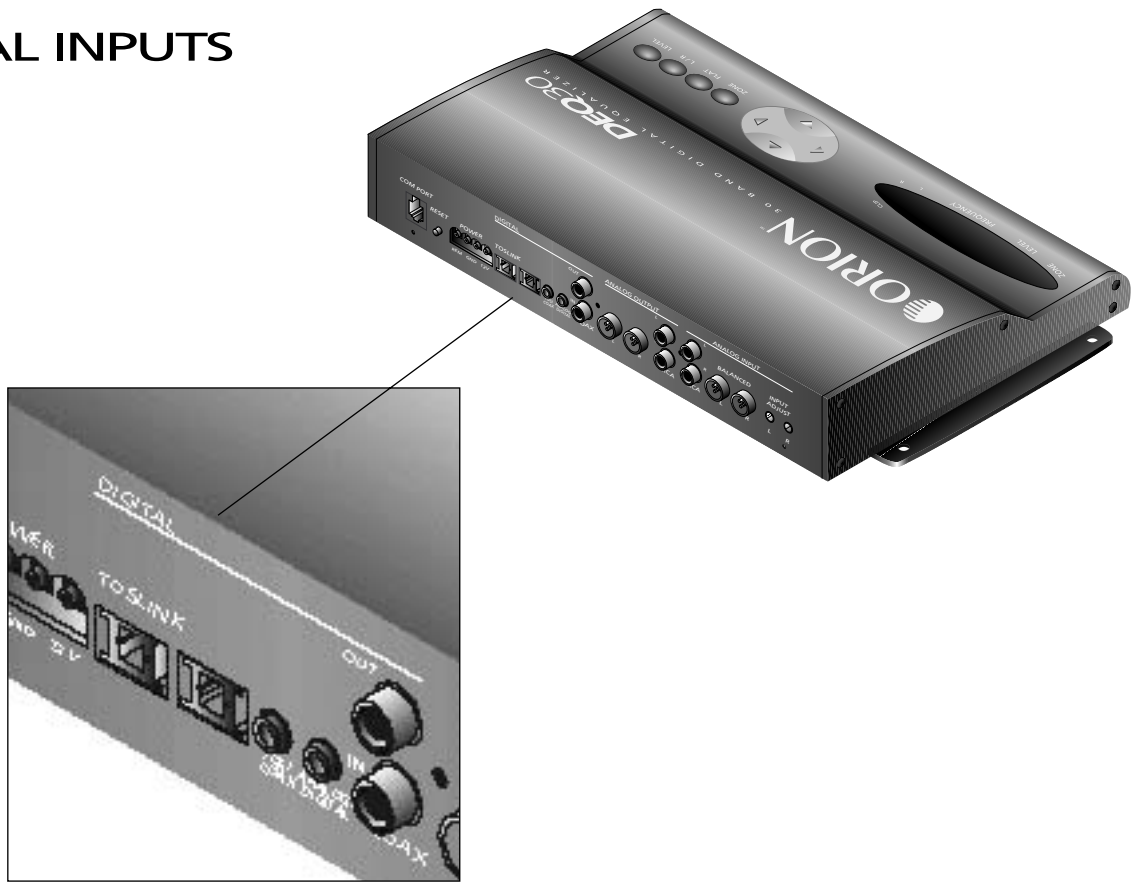


"CLIP" LED ILLUMINATES WHEN INPUT IS OVERLOADED.

Non CD Setup: Set source unit to 3/4 volume with dynamic content music. Set amplifier gains to their minimum position. Slowly turn up the gain controls of the DEQ 30. Be careful not to exceed the maximum output of the DEQ 30. Maximum output is exceeded when the "CLIP" LED indicator is illuminated.

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DIGITAL INPUTS



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Roll-off response errors are caused by deficiencies in driver performance, driver placement, enclosure design and vehicle acoustics. This type of response error usually is inaudible in all but the most demanding music. However for competition systems potential points can be lost with a system that has deficiencies in these areas.

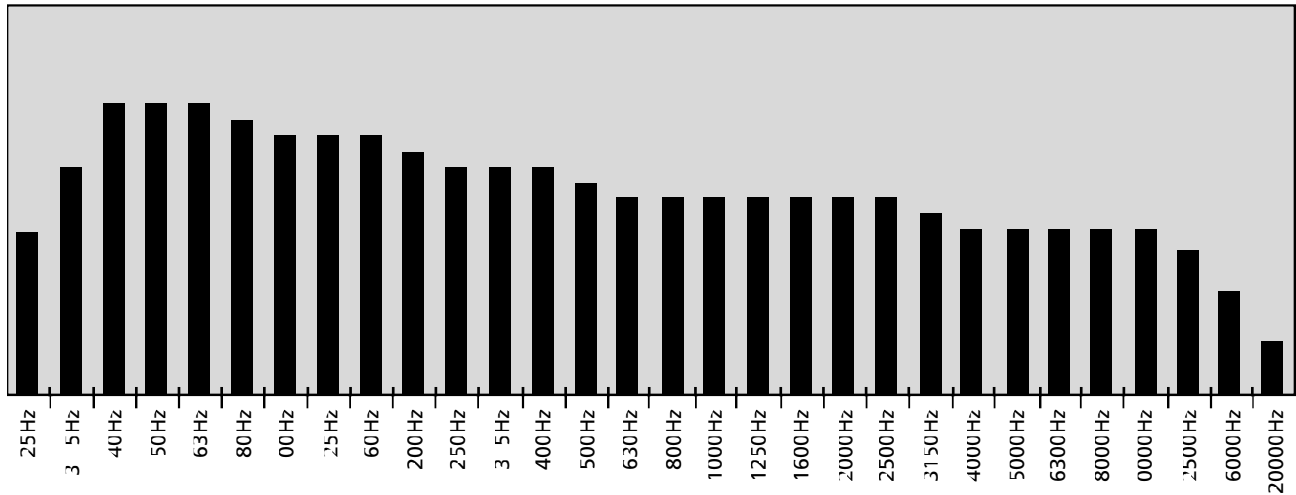
Non-Equalizer Solutions

Changing the tweeter positioning can improve the high frequency response of the system. Modifying the crossover works exceptionally well in passive crossover design that uses a resistor to attenuate the tweeters output. This can be accomplished by placing a capacitor between the positive input lead of the crossover and the tweeter positive output lead. Use a capacitor from this formula $[C= 1/(2\pi Rf)]$ where C is the capacitor value in farads, f is the starting frequency where the roll-off begins and R is the nominal impedance of the tweeter. In the above situation the nominal impedance is 4 , the starting roll-off frequency is 12,500Hz. The capacitance would be $[1/(2 \times 3.14 \times 4 \times 12,500)]$. The answer is 3.18×10^{-6} F or an approximate 3.3 μ F. Try larger and smaller values to create different response curves. For low frequency drivers you can try a different enclosure types or placement.

Equalizer Solutions

In this situation, boosting the DEQ 30 is really the only solution. Care must be taken not to exceed the excursion limits of the woofers and the power handling of the tweeter. Also, do not exceed the maximum undistorted output level of the DEQ 30. When you exceed the maximum output level, it is indicated by the illumination of the "Clip" LED located on the front display panel.

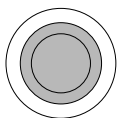
ROLL-OFF RESPONSE PROBLEMS



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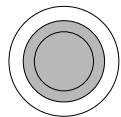
The DEQ 30 can accept a direct digital signal from a Compact Disc, Mini Disc or DAT source unit (44.1 kHz and 48 kHz sampling frequencies). Both TOSLINK and COAX connectors interface with a professional grade SPDIF receiver. That allows direct access to the digital processor inside.

SELECTING DIGITAL INPUTS



*ANALOG/
DIGITAL*

The Analog/Digital push button selector switch determines whether analog or digital inputs are used. When the push button switch is in the 'out' position, the DEQ 30 is configured for analog input (RCA or Balanced). When the push button switch is in the 'in' position, the DEQ 30 is configured for digital input (TOSLINK or COAX). When the digital output is selected, the level button when pressed accesses a digital attenuation control. This can be used for a volume control or to set the digital level of the system.

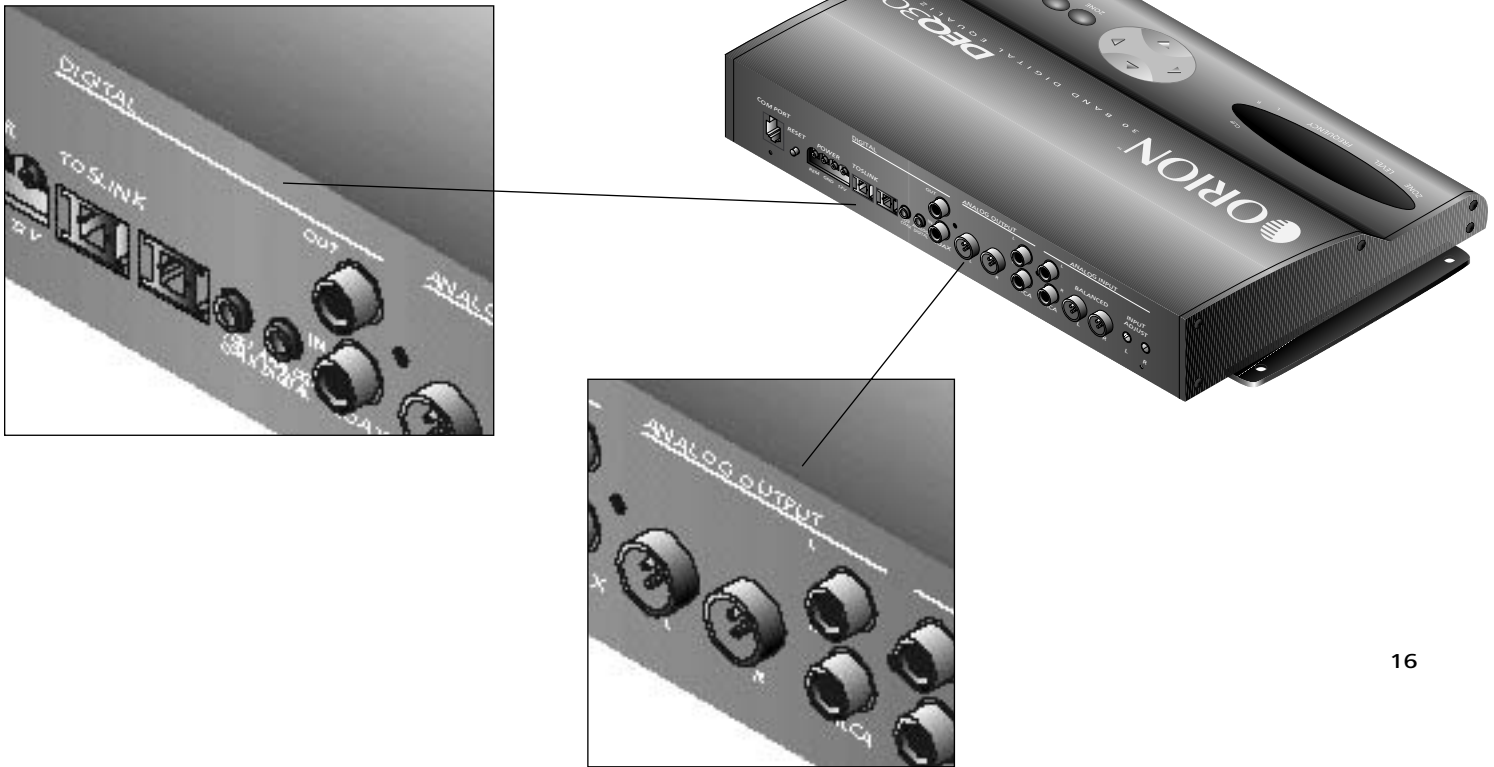


*TOS/
COAX*

The TOS/COAX push button selector switch determines whether the TOSLINK or COAX digital input is used. When the push button switch is in the 'out' position, the DEQ 30 is configured for TOSLINK (optical) digital input. When the push button switch is in the 'in' position, the DEQ 30 is configured for COAX (cable) digital input.

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ANALOG AND DIGITAL OUTPUTS



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Off-screen response problems are often a result of a system with a large quantity of woofers. In some situations, this may be a desirable result. If so, look for smooth transition from octave to octave. If your goal is competition, you must have all the bands on display at one time. This problem is very similar to the Output Level Incompatibility Problems discussed earlier.

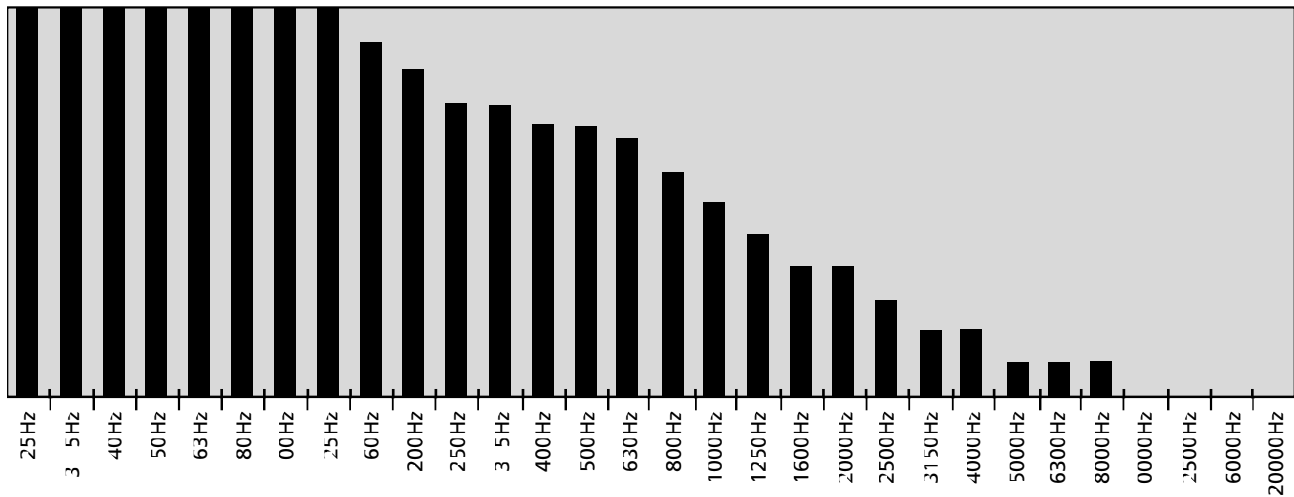
Non-Equalizer Solutions

Since this situation is similar to Output Level Incompatibility Problems discussed earlier, the solution to this particular problem is the same. First try balancing the output between the midrange and tweeter. For this example, reduce the level of the midrange. If you have passive crossovers between the midrange and the tweeters, increase the level of the tweeter. If you have an active system, balance the level between the midrange and the tweeter by raising the level of the midrange. Once you have achieved a balance between the tweeter and midrange integrate the level of the woofer by similar tuning techniques.

Equalizer Solutions

Use the DEQ 30 as a cut only device to try to smooth out the non-linearity of the system. Cut frequencies gradually starting with the center point of the problem area. Do not cut the centered band to get the frequency response to the flat position for it will dip below when you change adjacent bands. Periodically listen to your system during this process to make sure the changes you make do not adversely affect the detail and sound quality of the system.

OFF-SCREEN RESPONSE PROBLEMS



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The internal analog to digital converter uses dual 18 bit resolution bitstream auto calibration digital-to-analog converters made by Phillips. It has 192 times oversampling and features low harmonic distortion, no crossover distortion and digital de-emphasis for smooth highs and controlled low frequency response. The 18 bit wide dynamic range D/A converter is coupled with an ultra quiet pre-amplifier stage to deliver over 4 volts per phase (8 volts balanced) to either RCA or Balanced (mini-XLR™). Think of the DEQ 30 as a high performance digital to analog converter with a built-in 30 band equalizer!

Digital outputs incorporate a professional grade SPDIF transmitter that supports both TOSLINK and COAX digital connections. This allows for an outboard digital-to-analog converter or more digital processing.

You can choose any and all of the analog digital outputs depending on your systems needs. Make sure to make connections while the DEQ 30 is not powered on. Failure to do so may result in damage to your speaker system.

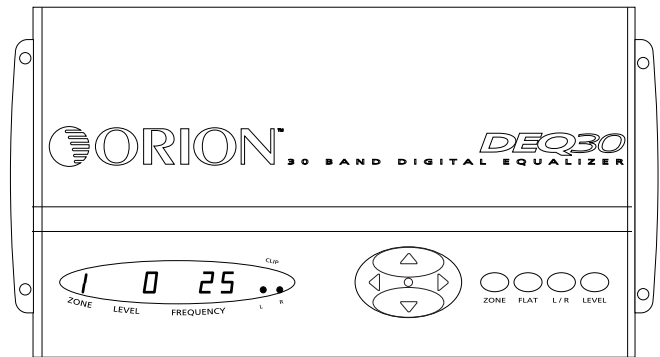
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USER INTERFACE

The user interface controls are designed to be concise and user friendly. Listed below are the descriptions of the user interface functions.

DIGITAL DISPLAY

ZONE	Indicates which preset Zone you are working in. There are four preset zones that store all information. To access the different zones, simply press the button marked "Zone."
LEVEL	Shows the amount of boost or cut in dB of a given frequency displayed in the frequency window. Range from -12dB to +12dB in 1dB increments.
FREQUENCY	Displays which frequency parameter the DEQ 30 is currently adjusting.



- Zone 1 Selected
- 0 dB of equalization
- Frequency selected 25 Hz

Crossover Points & Speaker Polarity Phase Shift Problems are cancellations caused by destructive interference as a result of integrating two drivers with crossovers. The above situation is a three way system with crossover points of 100 Hz and 2,500 Hz. In both situations, the driver interaction has caused a destructive interference at the crossover frequency.

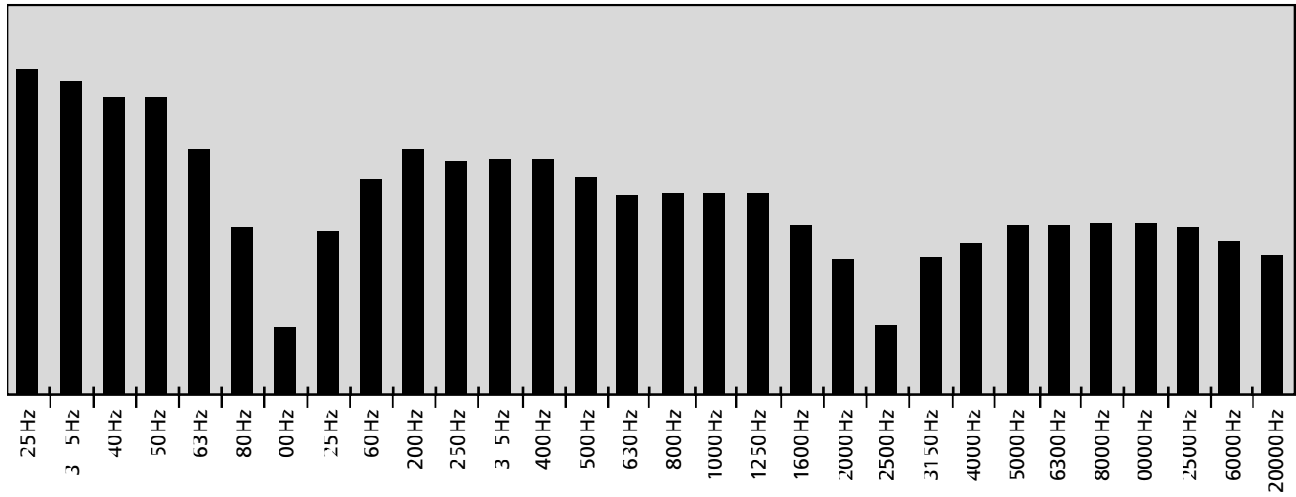
Non-Equalizer Solutions

The first thing to try is to change the polarity of one of the drivers. A general rule of thumb, change the polarity of the driver that has a lower operating band. In the above situation, first try inverting the polarity of the midrange to see if there is an improvement. If this does not improve the situation, return the polarity to its original setting and try using different crossover points for both the midrange and tweeter. Remember to use crossover frequencies that are at least as high as the recommended operating range. When dealing with multiple response errors, start with the highest frequency problem area and work downward.

Equalizer Solutions

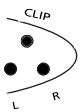
Use the DEQ 30 as a cut only device to try to smooth out the non-linearity of the system. Cut frequencies gradually starting with the center point of the problem area. Do not cut the centered band to get the frequency response to the flat position for it will dip below when you change adjacent bands. Periodically listen to your system during this process to make sure the changes you make do not adversely affect the detail and sound quality of the system.

CROSSOVER POINTS & SPEAKER POLARITY PHASE SHIFT PROBLEMS



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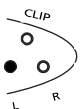
USER INTERFACE LED INDICATORS



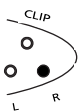
“CLIP” - When illuminated, indicates the EQ has clipped its output. There are three solutions to this problem: Reset input gains, turn down source unit (if using analog input) or lower boost on boosted frequencies.



“L” & “R” - Indicates which channel is to be equalized. In the default setting, both LEDs are illuminated indicating that both the left and right channels can be adjusted simultaneously. The channels are “LINKED.”



When only the “L” LED is illuminated, only the left channel is being adjusted. The channels are “UNLINKED.”

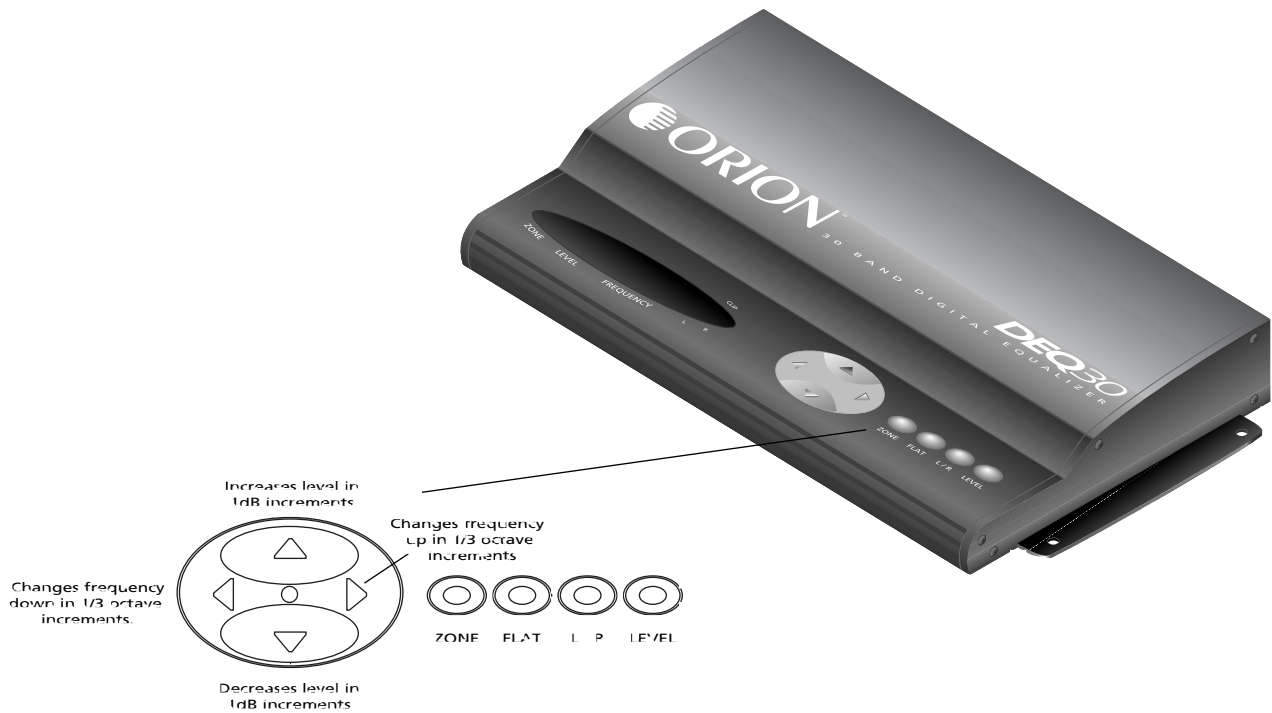


When only the “R” LED is illuminated, only the right channel is being adjusted. The channels are “UNLINKED.”

NOTE: When channels are unlinked, the left and right equalization can be adjusted independently.

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USER INTERFACE CONTROLS



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Output Level Incompatibility Problems are caused by a miss-match in output levels between woofers, midranges and tweeters. In the above graph, the midrange output level is lower than what is needed to match the woofers and tweeters. This is usually an easy problem to solve without the use of an equalizer.

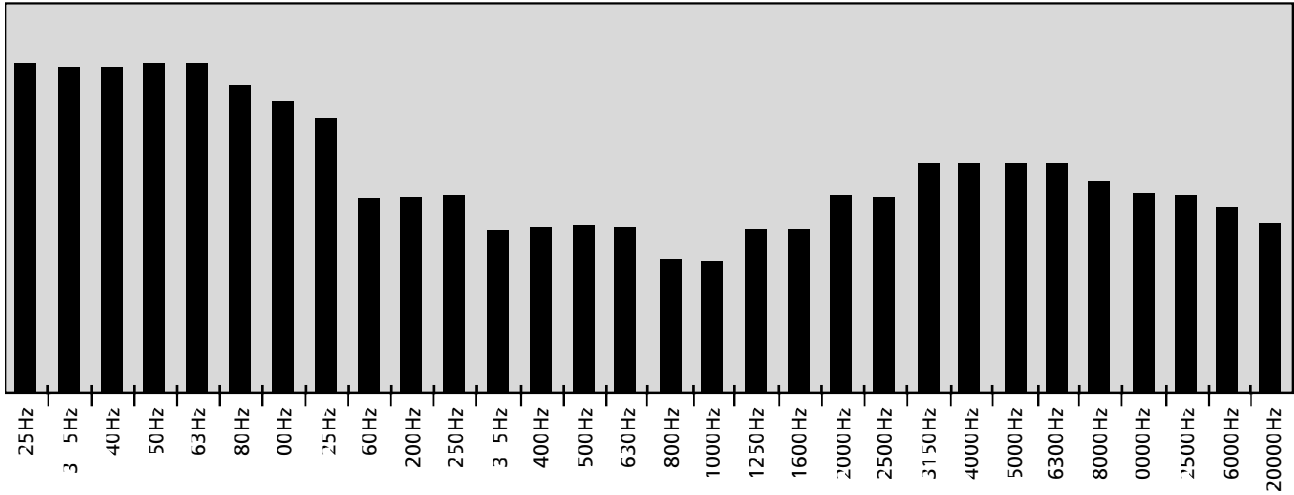
Non-Equalizer Solutions

First try balancing the output between the midrange and tweeter. For this example, reduce the level of the tweeter. If you have passive crossovers between the midrange and the tweeters, attenuate the level of the tweeter. If you have an active system, balance the level between the midrange and the tweeter by raising the level of the midrange. Once you have achieved a balance between the tweeter and midrange integrate the level of the woofer by similar tuning techniques.

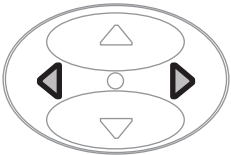
Equalizer Solutions

If you have followed the instructions above, there should be little need for equalization. However, if equalization is still required, use the DEQ 30 as a cut only device to try to smooth out the non-linearity of the system. Cut frequencies gradually starting with the center point of the problem area. Do not cut the centered band to get the frequency response to the flat position for it will dip below when you change adjacent bands. Periodically listen to your system during this process to make sure the changes you make do not adversely affect the detail and sound quality of the system.

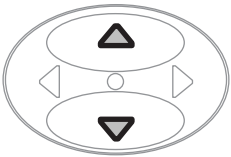
OUTPUT LEVEL INCOMPATIBILITY PROBLEMS



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- Pressing the left and right sides of the main user interface button selects one of 30 frequency bands in 1/3 octave increments from 25 Hz to 20 kHz.



- Pressing the up and down sides of the main user interface button changes the output level of selected frequency band from -12dB to 12 dB in 1 dB steps.



- Pressing the "ZONE" button selects between 4 preset zones. Each zone stores all individual band settings and level settings.



- Momentarily pressing the "FLAT" button resets the boost level of the displayed frequency to 0 dB. Holding down the "FLAT" button for 4 seconds resets the entire preset (working "ZONE") to the 0dB flat default position.



- Pressing the "L/R" button selects the DEQ 30 for either left channel, right channel or both channels to be adjusted. The channel being adjusted will be indicated by the illuminated LED indicators.



- Pressing the "LEVEL" button reconfigures the main interface button to control the digital output level of the DEQ 30. Use the up and down of the main user interface button to control the digital output level and integrate the DEQ 30 into a system with digital output source unit, or to control the volume of your system.

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BASIC EQUALIZATION

The DEQ 30 is a highly advanced signal processor. However, “highly advanced” does not mean difficult to use. There are two different levels of use for the DEQ 30. This section explains the basic utilization of the DEQ 30. To proceed, it is important that you familiarize yourself with the user interface display information and controls outlined in the previous section as the functionality of the DEQ 30 will be referenced but not outlined.

PREPARATION FOR EQUALIZATION

The DEQ 30 is one of many pieces in a system tuning process to achieve an awesome sound system. The purpose of equalization is only to smooth out slight imperfections in your system frequency response. You should add an equalizer to a system not as a solution to a problem but as an addition to an already awesome system. To take full advantage of the DEQ 30, first optimize your system setup without it.

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Constructive and Destructive interference occurs when two or more speakers (or a speaker and a reflective panel or baffle) interact with each other in such a way that creates erratic but repetitive frequency response errors. The response errors are determined by the frequency (wavelengths) and the speaker locations and phase relationships relative to the listening area. This type of frequency response error is different from resonance errors due to erratic nature (non-smooth peaks or dips) in the frequency response as well as the repetitive shape of the frequency response error itself.

Non-equalizer solutions

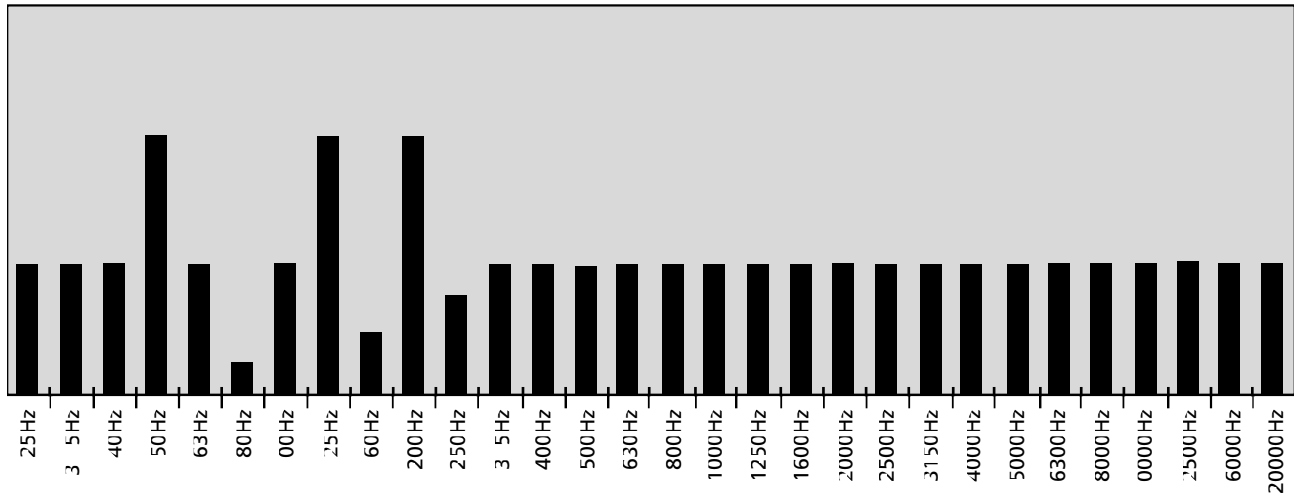
First, locate how the this problem is being created. What two drivers (or reflective surface or baffle) are causing this problem. Try changing the polarity of one the speakers to see if the situation improves. For high-frequency problems, try changing mounting angle and position as well as the polarity of the tweeters. For problems with drivers on the same channel, try changing the crossover point.

Equalizer Solutions

If the problem occurs between channels. Use the DEQ 30 to equalize the left and right channels separately. First pan to the left channel and smooth out non-linearities by using the DEQ 30 as a cut device first. Then pan to the right channel and repeat. Then sparingly use the DEQ 30 to boost the deficient frequencies for the left and right channels separately. Periodically listen to your system during this process.

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CONSTRUCTIVE & DESTRUCTIVE INTERFERENCE PROBLEMS



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Before you begin equalization it is strongly recommended that you accomplish the following:

- Choose good quality speakers (ORION, of course).
- Determine the best location for the midrange and tweeters. Speaker placement will make the most difference in sound quality, imaging, etc.
- Choose a woofer enclosure that best achieves your sonic and performance goals.
- Properly level set your system. This is the most important and most overlooked part of a system setup.
- Properly select crossover points and crossover slopes and speaker polarity. This part has a great effect on sound quality and frequency response.

Only after accomplishing the above items can you effectively and correctly equalize your system.

To begin with basic equalization, first, familiarize yourself with user interface controls as described in the "USER INTERFACE" section of this manual. In this section we will be equalizing both channels together. For optimum performance the DEQ 30 is designed to smooth out irregularities in your system frequency response. This section will deal with basic equalization without the use of any measurement device like a RTA (Real Time Analyzer).

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BASIC EQUALIZATION

When given the choice of boosting certain frequencies or cutting others, it is always better to cut frequencies. Boosting the equalizer requires the amplifier to produce more power. Boosting the equalizer 6dB is asking the amplifier to produce 4 times the power. It is easy to see how an amplifier can be overdriven at higher listening levels when the DEQ 30 is boosted.

With frequency response irregularities, human hearing is more sensitive to information added as opposed to taken away. As a result, you can use the DEQ 30 to locate and determine problem frequency areas. To accomplish this, choose music that you are very familiar with. For best results, choose music that is well recorded with acoustical instruments such as a piano or guitar and with both male and female singing voices. Also, an excellent reference system can be a live piano or an excellent sounding home audio system. Become familiar with your reference and feel free to refer to it to refresh your memory. Using your reference material, listen to your system at moderate listening levels. Do not choose listening levels too high as this will affect your results with potential overdriving of your amplifier and listening fatigue. Listening in short intervals of 15 minutes with rest period of at least 30 minutes will decrease your tuning time by reducing the possible mistakes in tuning that are made as a result of listening fatigue. As you become more aware of the effects of listening fatigue, you can better judge the duration of your listening interval to minimize this effect.

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Resonance is the tendency of a system to vibrate at a certain frequency when excited by an external force and remain vibrating after the force is removed. In the car audio environment, resonance frequency response errors are caused by vehicle acoustics. The lower resonant peaks are most often caused by the interior shape size and volume of the vehicle. The high frequency resonant peak are often found in vehicles where the tweeters are located near glass (windows and windshields).

Non-equalizer solutions

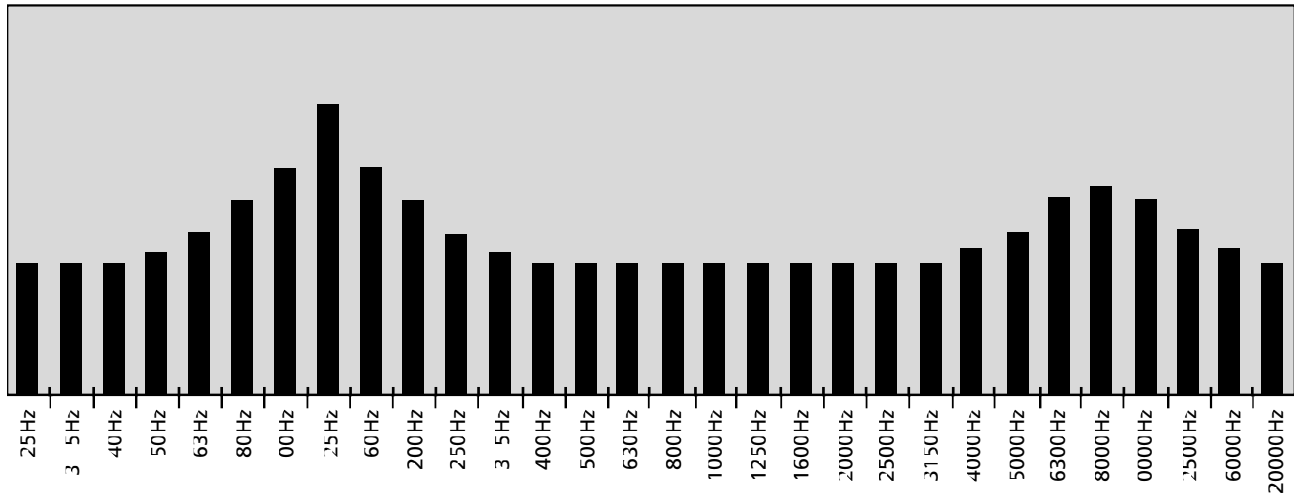
First try to see if the problem area is near a crossover point in your system. If so, try different crossover frequencies, staggered frequencies and different polarity of drivers to see if this improves the situation. For resonance problems in the high frequency tweeter range, try different tweeter angles and positions to see what improvements can be made to the system frequency response.

Equalizer Solutions

Second, use the DEQ 30 as a cut only device to try to smooth out the non-linearity of the system. Cut frequencies gradually starting with the center point of the problem area. Do not cut the centered band to get the frequency response to the flat position for it will dip below when you changes adjacent bands. Periodically listen to your system during this process to make sure that the changes you make equalizing do not adversely affect the detail and sound quality of the system.

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RESONANCE PROBLEMS



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While listening to your reference music, listen for irregularities in your system. These irregularities can best be described as tonal qualities your hearing finds offensive or irritating. To better locate a particular frequency range that needs correction, boost individual frequency bands (one at a time) until you find the offensive band. Remember to reset the non-effective bands back to 0dB to better locate the offensive band.

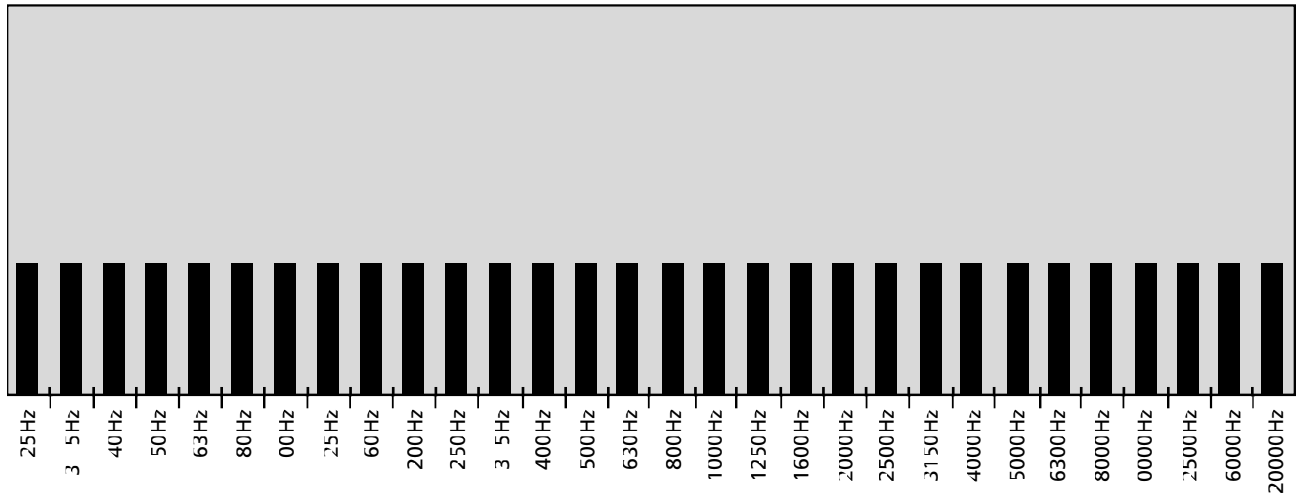
Once you have located the frequency band, slowly cut that particular band until the frequency aberration disappears. For best results, use the least amount of equalization (in this case, cut) as possible. This is important because as you reduce the offensive output, you also reduce the sonic information in that frequency range which will negatively affect the nuances and detail of the music. Also, when performing this correction, use different reference music to ensure that the equalization you are performing is correcting problems with your system and not a particular recording. Continue this process until all the frequency irregularities have been eliminated.

Since the DEQ 30 has four preset working zones, work in three of the zones and maintain another as a reference. Periodically, check the sound quality of the "corrected" response with the reference response. If you find that the corrected response sounds terrible in comparison to the reference response, take a listening break and listen to it again. Also, if you find you like the improvements of a particular zone but believe that it could be improved, leave it alone and set another zone to the same settings and continue. Compare the Reference, first selecting the most recent setting to see if actual improvements have been made. As before, take listening breaks often. Your hearing can be easily affected by extended listening and will limit your ability to make sonic improvements to your system.

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ADVANCED EQUALIZATION

PERFECTLY FLAT CURVE



This section is designed for people who will use the DEQ 30 in competition or people who desire the ultimate performance in their system. The DEQ 30 not only performs all of the equalization in the digital domain, it also has the ability to adjust equalization independently for the left and right channel. To fully take advantage of the DEQ 30, it is recommended to use a RTA (Real Time Analyzer). Several companies offer excellent units: Audio Control 3050A, Coustic RT33, Linear X PC RTA. In this section we will use the RTAs to evaluate and tune the DEQ 30.

An RTA (Real Time Analyzer) is a measurement device that provides a visual display of a system frequency response. Typically, this response is displayed in 1/3 octave bands. A 1/3 octave display has enough resolution to detect non-linear frequency response problems. Optimized to work in conjunction with the RTA, the DEQ 30 frequency centers correspond to the frequency centers of an RTA.

For a system to have decent sound, there needs to be a relative smoothness from band to band, octave to octave. For competition, a perfect system would have the same amplitude over the entire audible range. Listed are different types of frequency response problems and what course of action should be taken either with the DEQ 30 or other system adjustments or modifications.